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Date: 2004 January 6

From: Tom Carroll

To: NE/MA/OHRFCs, ER Hq, and CBRFC

Subject: Experiment to validate NOHRSC mean areal snow water equivalent estimates derived by SNODAS in the Eastern Region.

Re: Conference call, November 18, 2003: Joe Ostrowski, Ned Pryor, Tom Adams, Craig Hunter, Rob Shedd, George McKillop, Tom Carroll, and Don Cline.

Dec 4 update: This updates the December 1 email and summary that I distributed. The data content to be shipped to the NOHRSC is provided.

Jan 6 update: This updates the December 4 email and summary that I distributed. The file naming convention, data format, and ftp site to ship the data to are provided below.

The NOHRSC is now generating daily estimates of mean areal snow water equivalent for each RFC forecast basin in the U.S. The estimates are derived using the Snow Data and Assimilation Systems (SNODAS) energy-and-mass-balance snow model forced by the Rapid Update Cycle (RUC20) numerical weather prediction model fields. The model is run at 1-km<sup>2</sup> resolution and hourly time steps for the country. Additionally, the NOHRSC ingests all of the available, near real-time, snow depth and snow water equivalent data for the country. The snow observations are compared each day with the modeled state variables. In regions of the country where the modeled estimates disagree significantly with the observed snow data, a field of the difference between the two is manually generated and assimilated into the snow model state variables. Consequently, the SNODAS derived snow water equivalent estimates include information from the RUC model and associated observations, available ground-based snow depth and water equivalent data, airborne snow water equivalent data, and satellite areal extent of snow cover estimates.

The intent of the experiment is to assess the incremental benefit (if any) and biases associated with the SNODAS snow water equivalent estimates in contrast to RFC snow water equivalent estimates derived in the absence of SNODAS information. The hope is to assess the impact that SNODAS water equivalents have on the RFC river forecasts in contrast to RFC river forecasts generated using snow estimates void of any SNODAS influence.

We would like to take delivery at the NOHRSC in near real-time the results of each of

three model runs for all basins in all three RFCs. For the sake of communication, we'll call the three model runs: (1) SNOW17-OPS, (2) SNOW17-noSNODAS, and (3) SNODAS daily.

SNOW17-OPS-RUN1 is the traditional RFC run that uses all available snow information from all available sources and all SNOW17 MODS. It is the best forecast that the RFC can generate using all available resources.

SNOW17-noSNODAS-RUN2 is the traditional RFC run using all available snow information to estimate mean areal snow water equivalent except SNODAS information. As we discussed, this may be difficult to do; it will, no doubt, be subjective. If you changed your basin snow estimate for your SNOW17-OPS run because of SNODAS information, you should somehow estimate what that basin estimate would be in the absence of that SNODAS information. If the SNODAS and RFC estimates of mean areal snow water equivalent are pretty much the same, both runs would be the same. (This is what the OHRFC calls their "virgin" run.)

SNODAS daily-RUN3 is a run that you should pretty much be able to do using autopilot. This run would simply make a full replacement of the SNOW17 water equivalent state variable with the daily SNODAS estimates of basin snow water equivalent that we ship you daily.

Ideally, we would like to take delivery, each day, of the following variables for all RFC basins, for each of the three different runs: forecast stage (out to 72 hours), observed stage, mean areal basin precip, and all of the SNOW-17 state variables for all RFC basins. RFC basin selection. In contrast to what I mentioned earlier, it will probably be easier for you to dump data for all basins rather than a selected few. That way we will have the total area of the three RFCs covered and won't need to make any mid-course corrections if significant snow occurs in an unanticipated portion of the RFC area. Additionally, it would be good if each RFC could plan to select, perhaps, 3 or 4 basins that we could discuss each week. In order for this to work, it seems important that we ingest, process, discuss, synthesize, and summarize the results as we move through the snow season. I really don't want to get into a position where either we or you have to do a pile of work at the end of the snow season.

On December 3, Tom Adams, Joe Ostrowski, and I talked about the best format with which to transmit the required data to the NOHRSC. They both figured that they could write a single script (to minimize development effort) that could run in all three RFCs on a daily basis. Each day, each RFC would ship us a single file for each of the three SNOW\_17 runs described above (total of 3 files from each RFC each day) containing the following information in the pipe delimited format for all of their respective basins.

#### Data format, file naming convention and FTP site address.

Because SNOW\_17 state variables can be saved at only 12z, I suggest that we save and ship data only once per day in the following format:

SNOW\_17 run type | basin ID | date | forecast stage\_12z | forecast stage\_12z+24 hours | forecast stage\_12z+48 hours | forecast stage\_12z+72 hours | observed stage\_12z | mean areal basin precip\_12z | snowfall\_12z | rain on snow\_12z | energy exchange\_12z | areal extent of snow cover\_12z | percent liquid water\_12z | heat deficit\_12z | snow temperaturer\_12z | snow depth\_12z | snow on ground\_12z | simulated swe\_12z | observed swe\_12z | observed areal extent of snow cover\_12z | rain/snow elevation\_12z |

Note: SNOW\_17 run type = "ops" for the SNOW17 OPS run, = "noSNODAS" for the SNOW\_17 noSNODAS run, and = "SNODAS" for the SNODAS daily run described above. Also, it is necessary that all three RFCs use the same units in the same format for the same variables. This should be accomplished by the one-size-fits-all scripting software that Joe and Tom will pull together.

File name and data format The file name should be XXRFC\_2004\_MM\_DD\_HH where XX indicates which RFC, MM indicates month, DD indicates date, and HH indicates Z time. The data should be sent daily in pipe delimited ascii format as indicated above.

FTP site Andy Rost has provided the following information necessary for the RFCs to ftp the data to us:

The RFCs should follow the following steps:

- a) Create pipe delimited ASCII file (documented earlier) named xxrfc\_yyyy\_mm\_dd\_hh (ie, marfc\_2004\_01\_05\_06).
- b) Access our FTP site by entering: ftp <ftp.nohrsc.nws.gov> from the command line (make sure in the directory containing the file).
- c) Enter "anonymous" as the login name.
- d) Enter your email address as the login password; e) Change directory to incoming (cd incoming).
- f) Enter ascii to ensure that the file transfer type is network ASCII (this is the default type on some systems).
- g) Enter put xxrfc\_yyyy\_mm\_dd\_hh to download the file (ie, put arfc\_2004\_01\_05\_06); then, lastly h) Terminate by entering bye.

Have them contact me at (952)361-6610 x 234 or [arost@nohrsc.nws.gov](mailto:arost@nohrsc.nws.gov) if they experience difficulties.

#### ACTION ITEMS:

First Exercise: Joe, Tom, and Rob please provide me with any suggestions for change or modifications that you think we should consider by December 12. If you don't have any suggestions for change or modifications, please confirm by December 12 that you don't

see any difficulties with the proposed process and time frame and that on your end "Hey, man, there's no problem here!"

Second Exercise: It is critical for this effort to work that we are using identical basin boundaries that each RFC is using. Tom, Joe, and Rob should confirm that your respective RFC basin boundaries that are on our web site (GIS Data Sets) are, in fact, the basin boundaries that you are currently using. If you could confirm that they are the same by December 31, that would be good. If they are not the same, please send us your current basin boundaries by December 31.

Third Exercise: Joe and Tom will need to develop and test a script to output the data in the final format that we agree upon. If we could take delivery of a test data set by December 31, that would be useful. If we could have this whole show up and running by January 15 where we are taking delivery of 3 identically formatted files each day from each RFC, we can then begin to develop a web page that we all can use to monitor the process and products.

Let me know what you think.

Many thanks.

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